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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/660,813	09/12/2003	Hemant P. Mungekar	A8067/T51700	7055

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EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT PAPER NUMBER

1753

DATE MAILED: 07/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/660,813

Applicant(s)

MUNGEKAR ET AL.

Examiner

Rodney G. McDonald

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 May 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 8, 2006 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-15, 17, 18, 20-24, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. (U.S. Pat. 6,846,745) in view of Jimbo et al. (U.S. Pat. 5,756,402).

Regarding claim 1, Papasouliotis et al. '745 teach in Fig. 1B a process whereby a first portion of a film is deposited over the substrate from a first gaseous mixture flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 123; Column 6 lines 42-55) Thereafter etching the first portion by flowing an etchant gas comprising a fluorinated plasma. The fluorine containing plasma can include SiF_4 , SiH_2F_2 (i.e. this gas contains a halogen precursor (a fluorine precursor) and hydrogen precursor (a hydrogen precursor) similar to Applicant's concept where the hydrogen and oxygen are formed by a single compound), and NF_3 (i.e this gas contains a halogen precursor) for example. Other process gases can be included in the etchant plasma including oxygen, inert carrier gas and silicon-containing gas such as silane (i.e. a hydrogen precursor) (See Fig. 1B block 125; Column 8 lines 66-68; Column 9 lines 1-20) Thereafter a second portion of the film is deposited over the substrate from a second gaseous mixture of flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 129; Column 10 lines 21-24; Column 10 lines 50-53) The process is used for filling high aspect ratios. (See Abstract)

Regarding Claims 1 and 26 where the halogen precursor and the hydrogen precursor being flowed into the processing chamber at respective flow rates to control chemical interaction between the halogen precursor and the hydrogen precursor to provide a desired etch rate, Papasouliotis et al. '745 teach that the flow rate of the

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precursors can be controlled. For example the halogen precursor gas (i.e. NF_3 or SiH_2F_2) can have a flow rate of 0 up to about 500 sccm. The hydrogen precursor gas (i.e. SiH_4) can have a flow rate of 0 to 60 sccm. The oxygen precursor gas can flow at about 10 to 1000 sccm. (Column 9 lines 1-20)

Regarding claim 3, the halogen precursor comprises a fluorine precursor. (Column 8 lines 66-68; Column 9 lines 1-20)

Regarding claim 4, the fluorine precursor can be NF_3 . (Column 9 line 3)

Regarding claim 7, the fluorine precursor can be SiF_4 . (Column 9 line 2)

Regarding claims 11, 12, during the etching a high-density plasma is maintained. (Column 9 lines 24-25)

Regarding claim 13, the etchant can include an inert sputtering agent in the form of inert carrier gas. (Column 9 line 12)

Regarding claims 14, 15, the inert carrier gases are enumerated as helium, argon, and xenon. (Column 9 line 12; Column 9 lines 47-49)

Regarding claim 17, the deposition of the film is performed by maintaining a plasma. (Column 7 lines 53-65; Fig. 1B)

Regarding claim 18, the plasma is biased toward the substrate. (Column 8 lines 27-43)

Regarding claims 23, 26, Papasouliotis et al. '745 teach in Fig. 1B a process whereby a first portion of a film is deposited over the substrate from a first gaseous mixture flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 123; Column 6 lines 42-55) Thereafter etching the first portion by flowing an

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etchant gas comprising a fluorinated plasma. The fluorine containing plasma can include SiF_4 , SiH_2F_2 (i.e. this gas contains a halogen precursor (a fluorine precursor) and hydrogen precursor (a hydrogen precursor) similar to Applicant's concept where the hydrogen and oxygen are formed by a single compound) and NF_3 for example. Other process gases can be included in the etchant plasma including oxygen, inert carrier gas and silicon-containing gas such as silane (i.e. a hydrogen precursor) (See Fig. 1B block 125; Column 8 lines 66-68; Column 9 lines 1-20) The flow rates of the gases can be controlled. (Column 9 lines 12-20) Thereafter a second portion of the film is deposited over the substrate from a second gaseous mixture of flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 129; Column 10 lines 21-24; Column 10 lines 50-53) The process is used for filling high aspect ratios. (See Abstract)

Regarding claims 23, 27, the plasma can be biased toward the substrate during etching. (Column 9 lines 26-30)

The difference not yet discussed is the flow rate of the hydrogen precursor is not discussed (Claims 1, 26, 20), where the hydrogen precursor comprises H_2 is not discussed (Claims 2, 20), the substrate including silicon nitride and control of the hydrogen and NF_3 is not discussed (Claims 5, 21, 22), the fluorine precursor comprises F_2 is not discussed (Claim 6), the hydrogen precursor and the oxygen precursor in a single compound is not discussed (Claim 8), the single compound being water is not discussed (Claim 9), the single compound being hydrogen peroxide is not discussed (Claim 10), controlling the sputter removal ratio is not discussed (Claim 16), the control of the hydrogen gas to effect the etching distribution is not discussed (Claims 19, 25)

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and the control of the flow of the second precursor gas to provided a different distribution within the processing chamber than the first precursor gas, thereby effecting a nonuniform etching distribution over the substrate (Claim 28).

Regarding claims 1, 26, 20, Jimbo et al. teach etching a silicon nitride film or silicon oxide film (Column 2 lines 4-6) by utilizing a fluorine containing gas, an oxygen containing gas and a hydrogen containing gas. The hydrogen containing gas can be H_2 . (Column 3 lines 52-64) The flow rate of the hydrogen precursor gas can be 1000 sccm. (Column 5 lines 13-21)

Regarding claims 2, 20, Jimbo et al. teach etching a silicon nitride film or silicon oxide film (Column 2 lines 4-6) by utilizing a fluorine containing gas, an oxygen containing gas and a hydrogen containing gas. The hydrogen containing gas can be H_2 . (Column 3 lines 52-64)

Regarding claims 5, 21, 22, Jimbo et al. teach the substrate can have a silicon nitride film on a silicon wafer. (Column 2 lines 3-6) Jimbo et al. teach controlling the flows of the fluorine precursor and hydrogen precursor. The fluorine precursor can be NF_3 . (Column 5 lines 13-21; Column 3 lines 52-64)

Regarding claim 6, the fluorine precursor can be F_2 . (Column 3 line 56)

Regarding claims 8-10, the hydrogen precursor can be H_2O or H_2O_2 . (Column 3 line 60)

The motivation for utilizing features of Jimbo et al. is that it allows for selective etching. (Column 2 lines 4-6)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Papasouliotis et al. '745 by utilizing the features of Jimbo et al. because it allows for selective etching.

Claims 16, 19, 25 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. '745 in view of Jimbo et al. as applied to claims 1-15, 17, 18, 20-24, 26 and 27 above, and further in view of Papasouliotis et al. (U.S. Pat. 6,794,290).

The differences not discussed is controlling the sputter removal ratio (Claim 16), the control of the hydrogen gas to effect the etching distribution (Claims 19, 25) and the control of the flow of the second precursor gas to provided a different distribution within the processing chamber than the first precursor gas, thereby effecting a nonuniform etching distribution over the substrate (Claim 28).

Regarding claims 16, 28, Papasouliotis et al. '290 teach controlling the flow rate of argon to hydrogen to control the rate of sputtering and chemical etching. (Column 7 lines 7-20)

Regarding claim 19, 25, Papasouliotis et al. '290 teach controlling the flow rate of hydrogen in the chamber. (See Column 7 lines 7-20)

The motivation for controlling process gases and controlling process parameters is that it allows for achieving better control of etching rate. (Column 7 lines 1-2)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Papasouliotis et al. '290 because it allows for achieving better control of etching rate.

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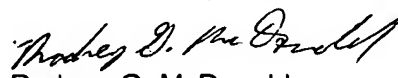
REMARKS:

In response to the argument that the prior art of record does not teach the claimed flow rates, it is argued that newly cited reference to Jimbo et al. suggest Applicant's required flow rates for use during etching. It is believed that the combination of references suggests the claimed flow rates. (See Jimbo et al. discussed above)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
July 12, 2006